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LOCO WEED.

By L. E. SAYRE, University of Kansas, Lawrence.

Read before the Academy, at Topeka, January 1, 1903.

THE subject of loco is a good deal like a tradition—it grows in the memory and in the imagination. There are plenty of facts to encourage, and, on the other hand, there are plenty of facts from equally good and authentic sources to discourage, the faith that we have placed in *Astragalus mollissimus* as a poisonous plant. This plant, it is well known, is said to cause dementia, some believing that the secret lurking power of this innocent wild pea extends beyond the lower animal, even to the human family. Applying the theory of "*similia*," we have found those who claim that in some remote future time we may find in this plant a valuable remedy for the cure of insanity. Members of the Academy may remember some reports made a few years ago in which a chemical analysis of the weed was given. Concentrated preparations of the plant, representing the alkaloid, were made and administered both to the lower animals and to *one member* of the human family. All live to offer themselves for further investigation; they neither affirm nor approve the statement that loco is the "crazy weed."

We would not have any one think for a minute that we discredit the ground for the opinion that, in some mysterious way, certain disorders occur among cattle in connection with what is commonly called "loco weed." But the problem is, What is this connection? What relation has *Astragalus mollissimus* to the disease of such varied symptoms, sometimes called "locoism"? If we could assume that the loco, like clover and alfalfa—belonging, as it does, to the same family—should have similar properties as a nitrogenous food, then we might find a similarity between it and a distemper or disease not unlike the ordinary class of diseases brought about by a disturbance in the digestive tract, such as may be expected when an animal in a half-starved condition is permitted to overfeed on alfalfa or clover. This condition, if continued, could naturally lead to a disturbance of the nervous system, of which the brain is the center. Take, for example, a poorly fed horse or cow, such as is characterized by the range-fed cattle in winter. Let either be suddenly supplied with plants from the pea family, rich in legumin, and the natural result would be a disturbance in the digestive tract, which might assume all

sorts of pathological symptoms, among these the "locoism" so poorly defined by various reporters.

This theory of the inciting cause of loco disease has been suggested in a former paper, and the additional evidence which has come to us since seems to confirm this theory, even though statements suggesting other theories are not wanting. For example, from Guimon, Okla., Mr. Oscar Glandville, to whom, by the way, we are indebted for a splendid lot of the plant—root, stem, and leaves—we obtain the following information, accompanying the consignment of the plant. He says: "If you will examine closely the plant sent, you will see, under the leaves of the unhealthy branches, small eggs. When a cow or a horse swallows these eggs by eating the leaves, the eggs hatch out, and the larvæ, wriggling about, seem to affect the brain." This is the ranchman's hypothesis, and he proves it to you by showing the stomach of an animal dead from the loco habit. He also cites you the year when the loco is healthy—no eggs are to be found on the leaves, no boring in the roots. He says these are the years when cattle can eat it without injury. Loco weed will be found unhealthy in one pasture and very thrifty in another. The pastures where the unhealthy weed exists is the only place where the cattle can get locoed. The ranchmen claim that this insect kills the loco out completely every seven years by boring into the root. This year the loco has been more healthy than common; consequently less cattle have been lost.

Mr. John Fields, director of the experiment station at Stillwater, Okla., addressed a recent live-stock convention on "How best to prevent loco." He said: "One either believes that there is something in this loco business, or he believes that there is nothing in it." He indicated that he had no fixed opinion himself. Quoting from his own word: "Our present activity along this line dates from a request made by Senator Marum, of Woodward, who has been studying and watching the habits of the loco plant growing there. He observed an insect that seemed to be killing off the loco, and another insect that killed the first one, and it was his idea that, by furthering the propagation of the loco-destroying insect, it might be possible to eradicate loco at small cost. The idea, he said, is an entirely feasible one, and presents many attractive features. He suggested a possible relation between the loco-eating habit and abortion in cattle. This, he stated, deserves immediate attention."

Mr. Fields referred to some loco experiments conducted by Doctor Lewis, veterinarian. The plant was fed to rabbits, with the expectation of "locoing" them. The leaves, the stems, the whole plant and an extract of the plant were fed to different lots of rabbits for a period of one to two months, without noticeable effect. Mr. Fields added

that these experiments proved nothing, only that further work must be done on this line with cattle.

Quoting from Doctor Lewis, Mr. Fields said: "We consider loco one of the worst enemies to stock on the plains. It affects cattle and horses about the same, and unquestionably it will produce abortion. Our mares and cows will not do us any good so long as its effects remain in their systems. If they eat much of it and do not abort, their young are deformed in some way; in fact, worthless."

This phase of the physiological action of loco is a new one to us, and we think should be recorded. As to the question of larvæ and insects for which the plant serves as host, one of these, found commonly upon the flowers and other parts of the plant, is known as the pea weevil, *Brunchus aureolus*. It is mentioned in *Insect Life*, volume V, page 166. The other one is known as *Walshia amorphilla*. The grubs of these have been frequently received in Washington for examination (*Insect Life*, vol. II, p. 50), the sender always being of the impression that the worms were the cause of the peculiar effect upon the live stock. But the report upon these insects is as follows: "The maggots are harmless larvæ of a little moth, *Walshia amorphilla*, which occur also in allied plants, boring into roots and stems."

The old theory that an alkaloidal poison is secreted in the plant, causing the loco trouble, has not been found tenable. But, on searching for a poisonous alkaloid, it has been discovered that a very minute quantity can be extracted, and this, when administered in solution to kittens, would produce only temporary inconvenience of a local character. Perhaps one of the most careful pieces of chemical work upon the plant, with a view of isolating the poisonous principle, was that of Doctor Power and Mr. Cambier, of the University of Wisconsin. In these experiments, one kilogram of the herb yielded 0.2 gm. of an alkaloid, equivalent to 0.006 per cent. This alkaloid was not found to be especially active, as when 0.2 of a gram was fed to a kitten, a frothing at the mouth and a profuse flow of saliva continued for half an hour, after which the animal finally recovered. These symptoms not uncommonly accompany the administration of many of the saponinoid principles of plants which are comparatively harmless. We are strongly of the opinion that the so-called locoism cannot be produced by any preformed alkaloidal principle existing in the plant. What alkaloidal substances may be formed by disturbed digestion in the presence of this nitrogenous food in the digestive tract has been only a matter of conjecture.

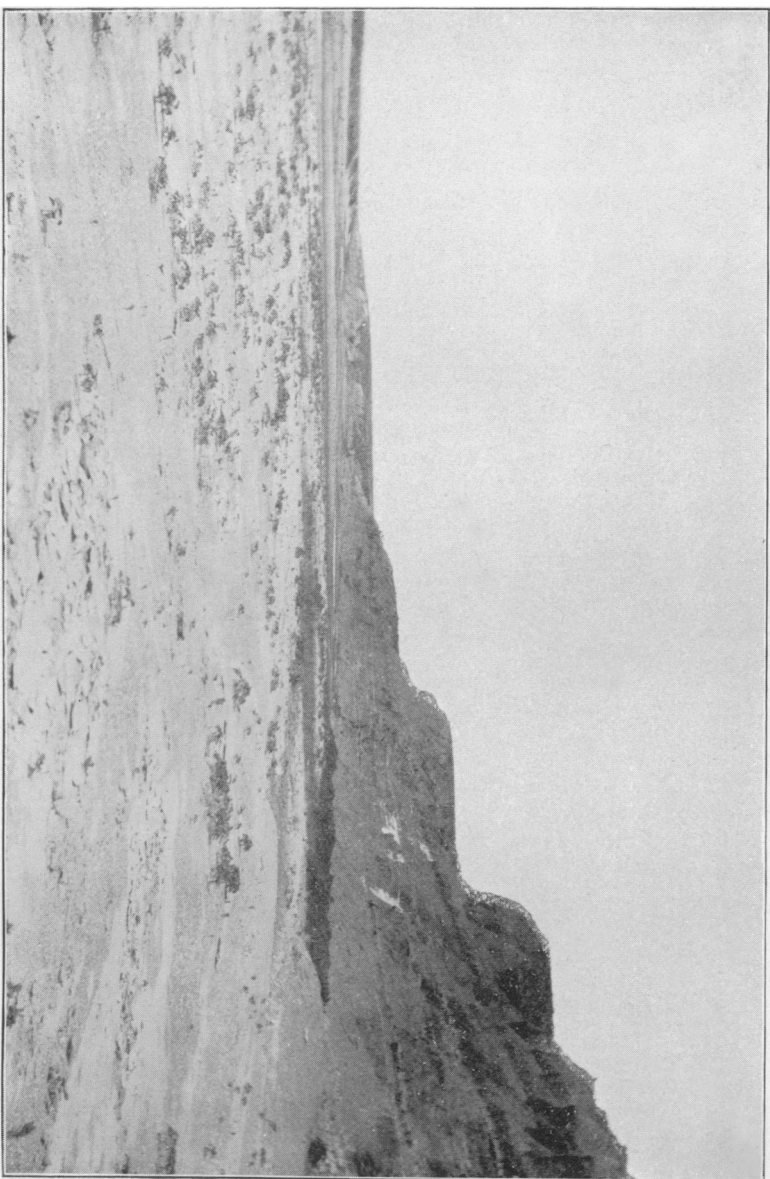
We have evidence of cases where the loco disease was entirely stamped out by carefully caring for, wintering and feeding stock according to more modern methods. Mr. J. P. Cone, now living in

Seneca, Kan., stated that in 1886 he, with another farmer, bought 250 head of cattle in the latter part of March; in the spring they were anxious to put them out to grass. The cattle were poor and underfed, and having a frail constitution—a characteristic of open-range cattle; that is, cattle wholly dependent upon nature's supply for food. When these cattle were placed into pasture of grass interspersed with loco they died off rapidly, a large percentage being lost. Mr. Cone and his partner investigated the matter for themselves, and came to the conclusion that the cause was due to the suddenness of food change. The following winter Mr. Cone states: "We put up feed for the winter, and our herds came to grass with healthier constitutions, and we did not lose another from loco weed, although it was as abundant as it had been formerly." Prof. L. G. Carpenter, of Fort Collins, informs me that the loco plant has been collected and fed to horses for some length of time, but a detailed report of these experiments is not yet available. Other reports have come to us that if the animal is in prime condition no fear of the loco weed need be entertained.

We do not wish to be understood as believing that the question of "locoism" has been settled by any theory we have advanced; on the contrary, as time and means permit, we shall continue the investigation, ready to follow up any suggestions which those who have had opportunities of observation have to offer. Some have suggested that the mysterious lurking power of the loco plant might be found in an organic acid. Accordingly we have taken this up for investigation, and have succeeded in isolating the acid of the plant. We are not able to report fully on physiological experiments with this acid as yet, but, so far as we have gone, it seems to be without toxic properties. We have also had the suggestion that the harm coming from this plant is due to the inorganic constituents; this clue has been followed up, but, like the others, has brought us no nearer to the solution of the problem.

Mr. Havenhill, assistant professor of pharmacy, finds the inorganic constituents as follows: Acid in oven-dry herb, 19.9 per cent.; of this, 5 per cent. is soluble in water. Ash in oven-dry root, 6.2 per cent.; of this, 33.5 per cent. is soluble in water. This shows the preponderance of the alkalies to be in the root. The analysis does not indicate a cause for any disorder or disease in connection with the plant.

We are now experimenting with the powdered leaves and stem in connection with an artificially prepared gastric fluid. Possibly we may find developed in appreciable quantity prussic acid. Such a reaction seems possible in the light of the experiments of H. B. Sledd upon sorghum. (See Trans. Amer. Chem. Soc., vol. XXV, p. 55.)



Smoky Hill River Valley, showing Shale Banks.